

eutrophic. Any water body, which has its source in a eutrophic lake, will itself be rich in nutrients. Sediment is a water constituent naturally yielded from erosion of the watersheds to water bodies in question. Excess sedimentation in these watersheds most often has its origin in roads developed for logging or access to a watershed and bank erosion associated with grazing. Roads may yield sediment directly from their surfaces or bed through mass wasting or their locations may cause the adjacent stream to begin bank cutting or incising its bed. Dissolved oxygen may be deficient in lakes and some streams as the result of the presence of biological oxygen demanding materials. Often eutrophic lakes have sufficient algal and weed growth to engender dissolved oxygen problems. Streams may have insufficient dissolved oxygen as a result of temperature exceedences. Oxygen solubility declines with increased water temperature. Temperature exceedences in these waters are often due either to insufficient water flow, alteration of the stream structure to a broad shallow morphology or lack of riparian vegetation to supply shading (Platts, Megahan and Minshall., 1983). Streams which have their source in shallow warm lakes often are warm as well. Oil and grease can be yielded to the streams by major roads such as an Interstate. Oil may be yielded after rains to nearby streams. Oil and tar have been spilled during accidents on these roads and these materials can find their way into the nearby streams. Excessively low pH normally results from acid mine drainage or from mill tailings materials associated with mining. Although a few natural acid rock drainages can be found in the sub-basin, data indicates these do not alter the pH of streams, significantly.

### **2.3.2. Available Water Quality Data**

The available data for the water bodies of the 1998 list are provided in the following sections.

#### **2.3.2.1. Coeur d'Alene River**

Water temperature and pH data have been collected on the Coeur d'Alene River as part of three years of metals monitoring. The pH data are from composite water samples collected monthly or bimonthly at the Cataldo, Rose Lake and Harrison monitoring stations (Table 4). The recorded pH values range between 6.5 and 7.5 and consistently have mean values above neutrality. These are typical pH values for the waters of northern Idaho. The data do not indicate any exceedence of the general aquatic pH standard (6.5-9.5)(IDAPA 16.01.02.250.a.i.). Water temperature data were collected near the shore at the three monitoring stations as a part of the sampling procedure (Table 5). Water temperatures exceed cold water biota criteria in a very few cases during warm summers. Since these data were collected near shore, they are likely a few degrees warmer than water temperature offshore and at depth in the river. A few midsummer shore temperatures were in excess of the cold water biota standard (22°C)(IDAPA 16.01.02.250.c.ii.). Data developed by Golder and Associates (1998) support the data collected by DEQ, but none of these data were collected at depth in the river. In addition, sufficient data were not available to assess the daily average temperature cold water biota standard. To address this data gap, water temperature was continuously measured at the Harrison and Bull Run Bridges during the summer of 1999. The sensors were placed at four levels and three locations in the river at the Harrison Bridge and at two levels in the river at the Bull Run Bridge. The results from the eight sensors at the Harrison Bridge were remarkably similar. The

between early July and late September. A lower number of exceedences occurred at depth. At the Bull Run Bridge the standard was exceeded 10% of the period at depth and 16% nearer the surface. The results indicate the river, which is too broad to be shaded, warms as it flows slowly downstream to the lake. However, the river exceeds the average temperature standard for cold water biota upstream. These results demonstrate the river is exceeding the current temperature standard for cold water biota.

Salmonid spawning occurs only in the reach of the river between the confluence of the North and South Forks of the river and Skeel Gulch (segments 4021 and 4018). This reach has riffles and

Table 4: Mean and deviation of pH data collected for three water years at the Cataldo, Rose Lake and Harrison Monitoring Stations on the Coeur d'Alene River.

	pH Data for W Y 1995		pH Data for W Y 1996		pH Data for W Y 1997	
Station	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Cataldo	7.09	0.24	7.23	0.22	7.12	0.15
Rose Lake	7.06	0.31	7.29	0.27	7.15	0.17
Harrison	7.15	0.21	7.11	0.17	7.20	0.19

gravels conducive to spawning. This reach has chinook salmon (September 15 to April 1) rainbow and cutthroat trout (January 1 to July 15) and whitefish (October 1 and April 1) spawning (IDAPA 16.01.02.250.d.iv.). The Cataldo monitoring station is located on this upper reach of the river. Temperatures are sufficiently low for whitefish spawning. ( $<13^{\circ}\text{C}$ ) (IDAPA 16.01.02.250.d.ii.). Temperatures recorded in September exceed numeric temperature standards for chinook salmon spawning. Temperatures recorded in June and July exceed numeric temperature standards for rainbow and cutthroat trout spawning. The thermograph data collected downstream during the summer 1999 suggests that salmonid spawning temperature standards are violated. On the weight of the available evidence it appears that numeric salmonid spawning standards are regularly exceeded in the upper reach of the river.

Despite these temperature measurements, young of the year trout and salmon are easily observed along the upper reach of the river. Observation of numerous young of the year is normally taken as a strong indication that spawning is successful. This observation suggests that trout and salmon have acclimated or adapted to temperature conditions by spawning earlier in the case of rainbow and cutthroat or delaying until later in the case of chinook salmon to take advantage of cooler stream conditions.

Table 5: Temperature Data for the Coeur d'Alene River .																
Water Year1995																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Sep
CATALDO						5.0	5.0	7.0	7.9	10.5	14.0	14.5	16.0	16.0	15.5	17.0
ROSE LAKE						5.0	5.0	9.0	9.0	13.0	16.0	17.0	19.0	19.0	16.0	18.0
HARRISON						5.5	3.5	9.0	9.0	15.0	15.0	19.0	22.0	21.0	19.0	20.0
Water Year1996																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep				
CATALDO	9.0	4.0	1.0	1.5	0.0		5.0	7.5	11.0							
ROSE LAKE	9.5	4.5	1.0	1.5	0.0		5.0	8.0	11.0							
HARRISON	9.0	6.5	1.5	2.5	1.0		6.0	9.0	14.0							
Water Year1997																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep				
CATALDO	8.0	5.0	2.0	2.0	2.0	5.0	7.0	6.9	10.2	15.7	17.0	16.0				
ROSE LAKE	8.0	4.0	3.0	1.5	3.0	5.0	6.5	8.8	11.5	18.3	19.2	17.4				
HARRISON	8.0	5.0	3.0	1.0	4.0	6.0	7.0		13.6	19.9	21.6	20.2				
Water Year1998																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep				
CATALDO	11.4	5.4	3.6	2.8	3.1	4.2	8.0	7.3	13.1	20.1	17					
ROSE LAKE	10.8	5.0	3.8	3.1	3.5	4.3	8.5	8.0	14.9	23.0	19					
HARRISON	11.4	4.9	3.3	2.7	3.8	4.4	9.9	8.9	15.6	25.2	21					
Note.																
Temperature in degrees centigrade.																
Temperature taken from the bank.																

### 3.2.2.2. Latour, Larch and Baldy Creeks:

Latour Creek and its tributaries, Larch and Baldy Creeks, had continuous temperature measurement during the summer of 1997. These data (figures 3-5) indicate that temperatures supportive of cold water biota are maintained by these streams year-round. The principle spawning salmonids of these drainages would be cutthroat and brook trout and whitefish. Temperature data are not available for the October 1 to April 1 spawning period of brook trout and cutthroat trout. This period is bracketed by the warmer summer and early fall period. The data suggest the temperature standard is not exceeded during the fall and winter incubation months. The data do indicate the salmonid spawning temperature standard ( $<13^{\circ}\text{C}$ )(IDAPA 16.01.02250.d.ii.) was exceeded during July 1997 on these streams.

Bacteria are also listed as a pollutant of concern on these three streams. These are largely forested watersheds with some dispersed residential development along lower Latour Creek. The Bureau of Land Management has land management responsibilities in these watersheds. No current grazing permits are operating in these watersheds. The last permits were terminated in 1988 (BLM, 1998). The absence of livestock grazing in a significant amount would suggest bacterial contamination is no longer an issue in these sub-watersheds. No other significant bacterial sources exist.

The lack of bacteria contamination was confirmed during the low discharge period of summer 1999. Water samples from Larch, Baldy and Latour Creeks were analyzed for fecal coliforms and *Escherichia coli* (E-coli). The Baldy and Latour Creeks were found to have seven or less per 100 mL in each case. Larch Creek had slightly higher fecal coliform and E coli counts of 28 and 20 per 100 mL, respectively (BURP, 1999). These values are sufficiently well below the fecal coliform primary contact standards of 500 fecal coliform per 100 mL and the proposed recreational standard of 406 E. coli per 100 mL that no additional testing was deemed necessary.

Figure 3: Latour Creek Temperature Data Summer 1997

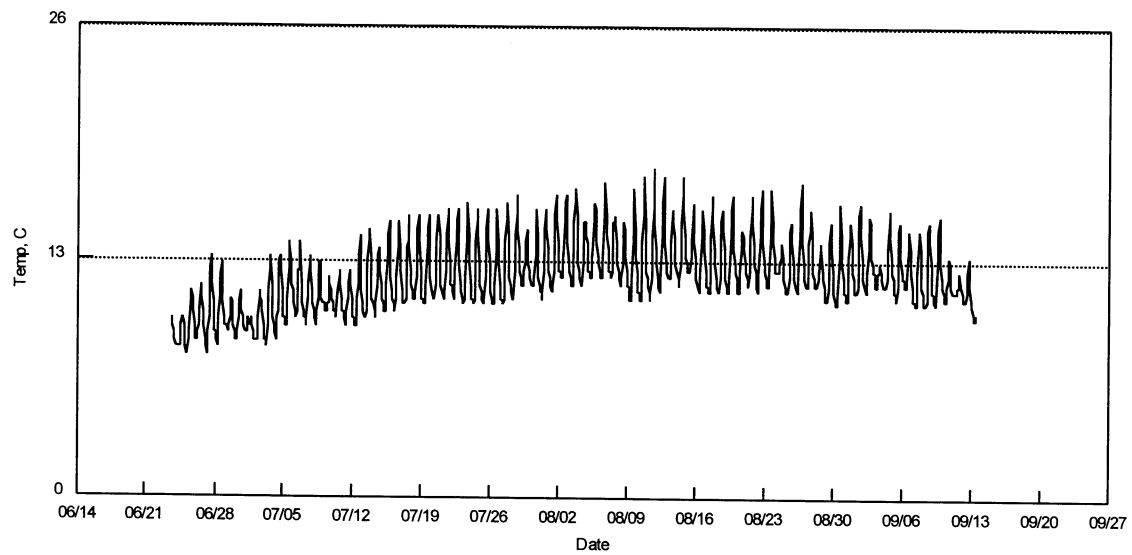


Figure 4: Larch Creek Temperature Data Summer 1997

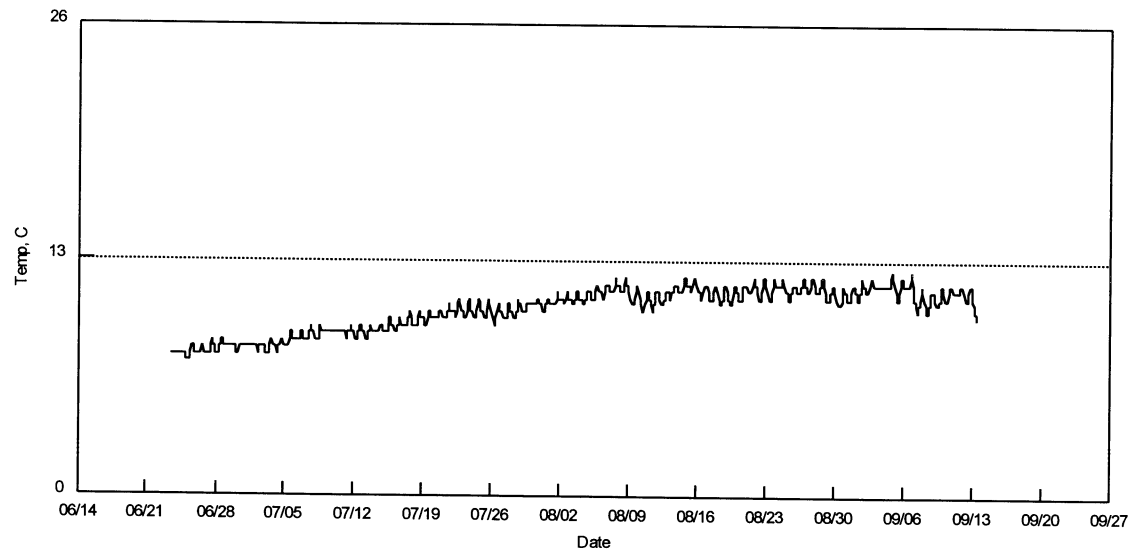
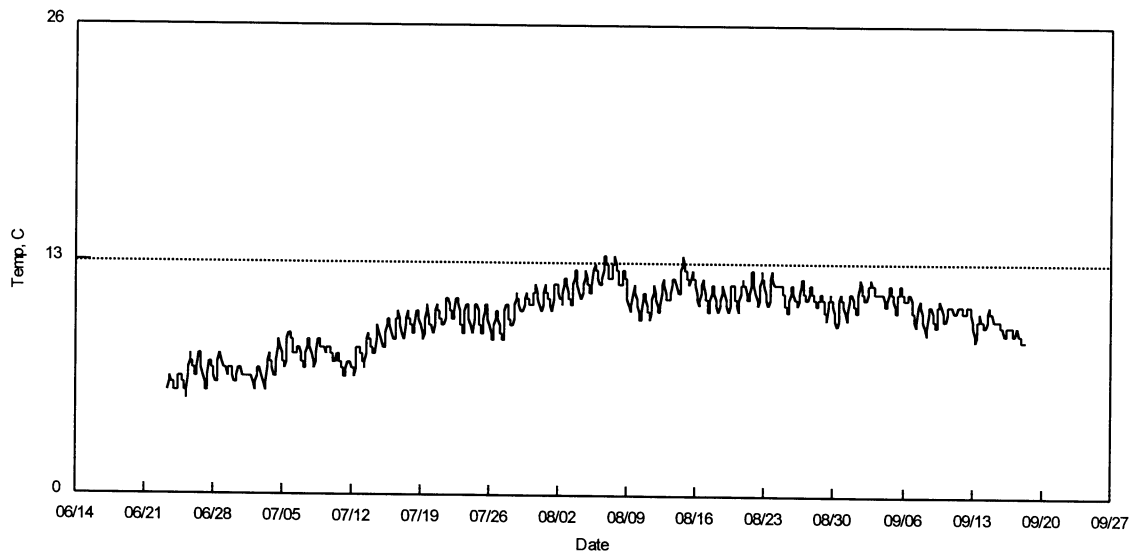


Figure 5: Baldy Creek Temperature Data Summer 1997



### 2.3.2.3. Black Lake:

Black Lake is a floodplain lake of the Coeur d'Alene River. The eleven floodplain lakes of the Coeur d'Alene River Valley are shallow, warm during the summer months and generally eutrophic (Table 6) (USGS 1993).

Table 6: Lateral Lakes Water Quality Nutrient Data 1992

Lateral Lake	Total Inorganic N (mg/L)	Total Organic N (mg/L)	Total P (mg/L)
Anderson	0.058	0.35	0.039
Black	0.020	0.85	0.046
Blue	0.021	0.20	0.010
Bull Run	0.021	0.35	0.063
Cave	0.033	0.25	0.058
Killarney	0.044	1.00	0.012
Medicine	0.016	0.35	0.085
Rose	0.252	0.80	0.058
Swan	0.078	0.55	0.013
Thompson	0.010	0.20	0.012

Note: Data not collected for Porter Lake

The generally accepted total phosphorous criterion for nuisance weed growth in lakes is 25 ug/L (USEPA, 1972). Black Lake total phosphorous values collected in 1992 (Table 6) and in 1997 (Table 7) indicate the lake is well above the criterion (approximately 50 ug/L). Table 6 indicates that eight of the ten lateral lakes measured are above the criterion and that Black Lake, is intermediate in its phosphorous level. The nutrient level of Black Lake and other lakes of the Coeur d'Alene River floodplain are typical of self-fertilizing eutrophic lakes (IDEQ, in draft). These lakes have likely been eutrophic for thousands of years (Rember, 1999). Organic and inorganic nitrogen levels support this interpretation. Eutrophy is simply a gauge of the nutrient status and age of the lake. The beneficial uses of Black Lake, which supports warm water biota, primary and secondary contact recreation, are not impaired by its eutrophic nature. The trophic status of Black Lake in relation to its expected condition as a small shallow floodplain lake does not support water quality limited listing for nutrients.

Table 7: Black Lake Water Quality Nutrient Data 1997

Location	Total Inorganic N (mg/L)	Total Phosphorous (mg/L)
Mid-lake	0.039	0.055

#### 2.3.2.4. Wolf Lodge Creek

Absence of the reported bacteria contamination was found during the low discharge period of summer 1999. Bacterial samples from Wolf Lodge and Stella Creeks were analyzed from fecal coliform and E-coli. The streams were found to have 22 and 11 fecal coliform per 100 mL and 33 and 10 E-coli per 100 mL (BURP, 1999). These values are sufficiently well below the fecal coliform primary contact standards of 500 fecal coliform per 100 mL and the proposed recreational standard of 406 E. coli per 100 mL that no additional testing was deemed necessary.

Nutrients supportive of aquatic plant growth were assessed on water samples from Wolf Lodge Creek. Total phosphorous concentration was 14 ug/L as phosphorous. The guideline used by DEQ for interpretation of the excess nutrients narrative standard is 100 ug/L total phosphorous in flowing streams (USEPA, 1972). Total Kjeldahl nitrogen was 100 ug/L, while nitrate-nitrite analysis was 142 ug/L as nitrogen. The nitrogen data indicates that nearly all the nitrogen is in the form of nitrate-nitrite. The guideline for excess nitrate is 300 ug/L as nitrogen (Sawyer, 1947; Müller, 1953). The concentrations measured in Wolf Lodge Creek are less than half the guideline indicating the stream is not water quality limited by nitrogen.

#### 2.3.2.5. Fernan Lake and Creek

A lake water quality assessment was completed on Fernan Lake during the 1991 field season (Mosier 1992). Nutrient data indicate the lake was mesotrophic (Table 8) and was not exceeding the nuisance weed growth criterion. Additional parameters collected in 1991 support the mesotrophic

condition of Fernan Lake. Algal blooms have commonly been observed on the lake suggesting it is at or close to a eutrophic classification. The lake is currently in a state that intervention in the watershed could reduce phosphorous export to the lake and slow the pace of eutrophication. The possibility that the lake would become anoxic in its bottom waters is remote. The lake is relatively shallow (7 meters) allowing for wind driven re-oxygenation even at depth. Dissolved oxygen measurements completed at the time of the assessment showed bottom water to be low in oxygen during the summer (0.8 mg/L), but not anoxic. Water quality measurements collected to date from Fernan Lake do not violate water quality standards. However, the lake is close to violations and algal blooms occur on a yearly basis. An advisory TMDL should be developed for the lake based on further measurements of phosphorous loading.

Table 8: Fernan Lake Water Quality Average Nutrient Data

Location	Total Inorganic N (ug/L)	Total Phosphorous (ug/L)
mid-lake	50	21

Fernan Creek is listed for bacteria, dissolved oxygen, habitat alteration, nutrients and sediment. The stream currently has stable banks with stable vegetation. Sediment sources to the immediate stream are few and not severe. Upstream sources are precluded by Fernan Lake. No apparent source of bacteria exists. The habitat may have been altered in the past but stable habitats have reestablished along the stream. The stream is well shaded and shallow suggesting oxygen level would not be a problem. The pollutant listing on the 1998 303(d) lists may well date back to 1988 when the golf course and highway were under construction. A decade has past since the construction period. Vegetation has reestablished reducing sedimentation and producing habitats. The creek likely has a residual nutrient problem associated with its primary source of water, Fernan Lake, and possibly exacerbated by fertilization of the adjacent golf course.

Water samples from Fernan Creek were collected for fecal coliform and E coli analysis during the low discharge period of summer 1999. Analysis indicated four fecal coliform and ten E coli per 100 mL (BURP, 1999). These values are sufficiently well below the fecal coliform primary contact standards of 500 fecal coliform per 100 mL and the proposed recreational standard of 406 E. Coli per 100 mL that no additional testing was deemed necessary.

The stream likely does receive water enriched in nutrient from the lake. The golf course which flanks the west edge of the quarter-mile segment may also be a source of nutrients dependent on the turf management. The lower eighth-mile of stream fronts the golf course on one side. It is unlikely that a short segment would receive an important nutrient load or it would have an affect before discharge to the lake.

Nutrients supportive of aquatic plant growth were assessed on water samples from lower Fernan Creek. Samples were collected above the golf course. Total phosphorous concentration was 28 ug/L as phosphorous. The guideline used by DEQ for interpretation of the excess nutrients narrative

standard is 100 ug/L total phosphorous in flowing streams (USEPA, 1972). The total phosphorous concentration measured for the creek is well below the guideline. Total Kjeldahl nitrogen was 230 ug/L as nitrogen, while nitrate-nitrite analysis was 290 ug/L as nitrogen. The nitrogen data indicate that most of the nitrogen is in the form of nitrate-nitrite. The guideline for excess nitrate is 300 ug/L as nitrogen (Sawyer, 1947; Müller, 1953). The concentration measured in lower Fernan Creek is quite close to the guideline, but below it. The high nutrient level most probably has its origin in Fernan Lake.

#### 2.3.2.6. Cougar and Kidd Creeks

Nutrients supportive of aquatic plant growth were assessed on water samples from Cougar and nearby Kidd Creeks. Cougar Creek's total phosphorous concentration was 62 ug/L as phosphorous. Total Kjeldahl nitrogen was 190 ug/L as nitrogen, while nitrate-nitrite analysis was 156 ug/L as nitrogen. Kidd Creek's total phosphorous concentration was 43 ug/L as phosphorous. Total Kjeldahl nitrogen was 130 ug/L, while the nitrate-nitrite nitrogen measure was in error. The guideline used by DEQ for interpretation of the excess nutrients narrative standard is 100 ug/L total phosphorous in flowing streams (USEPA, 1972). Although Cougar and Kidd Creek's phosphorous concentrations are higher than expected, they are well below the guideline concentration. The guideline for excess nitrate is 300 ug/L as nitrogen (Sawyer, 1947; Müller, 1953). The concentration measured in Cougar Creek is roughly half the guideline. The Kidd Creek nitrogen data indicates the stream does not exceed the guideline, but additional testing of nitrate-nitrite is necessary. Unfortunately Kidd Creek does not flow late in the summer season.

#### 2.3.2.7. Mica Creek

Water samples from Mica Creek and the North Fork Mica Creek were collected for fecal coliform and E. coli analysis during the low discharge period of summer 1999. Summer discharge measurements (2.5 cfs) indicate that secondary contact is the appropriate beneficial use for the stream. Both the acute (800 fecal coliform/ 100 mL) and chronic (geometric mean of 200 fecal coliform/100 mL) standards protective of secondary contact recreation were exceeded (Table 9). Analysis for E. coli was also made in anticipation of the proposed bacteria standard. Both the acute and chronic levels of this proposed standard were violated. The results indicate that Mica Creek and its North Fork are water quality limited by coliform bacteria. A TMDL addressing both the current fecal coliform and proposed E coli standards will be developed.

Table 9: Fecal and E. coli bacteria from two locations on Mica Creek

Date	Mica Creek FC	Mica Creek EC	NF Mica Creek FC	NF Mica Creek EC
7/23/99	5100	2900	400	180
7/23/99		1300		200
7/27/99	570	150	600	130
7/30/99	730	630	500	380
8/4/99	800	220	720	190
8/24/99	570	300	600	300
Geometric Mean	993	535	553	216

Nutrients supportive of aquatic plant growth were assessed on water samples from Mica Creek and the North Fork Mica Creek. Total phosphorous concentration was 33 ug/L and 22 ug/L as phosphorous for Mica Creek and its North Fork, respectively. The guideline used by DEQ for interpretation of the excess nutrients narrative standard is 100 ug/L total phosphorous in flowing streams (USEPA, 1972). Total Kjeldahl nitrogen was 140 ug/L as nitrogen, while nitrate-nitrite analysis was 112 ug/L as nitrogen for Mica Creek. Total Kjeldahl nitrogen was 110 ug/L as nitrogen and 133 ug/L as nitrogen for the North Fork. The nitrogen data from both streams indicate that most of the nitrogen is in the form of nitrate-nitrite. The guideline for excess nitrate is 300 ug/L as nitrogen (Sawyer, 1947; Müller, 1953). The concentrations measured in Mica Creek and its North Fork are less than half the guideline, indicating the streams are not water quality limited by nitrogen.

#### **2.3.2.8. Lake Creek**

Considerable water quality monitoring has been completed on Lake Creek, most recently for 1996 through 1998 (Bauer, Golden and Pettit, 1998). The stream transports large amounts of fine sediment primarily from agricultural fields and stream banks during high discharge events. The most recent work has found statistically significant and strong correlations between turbidity, suspended sediment and total phosphate and the signal output of an optical particle sensor. During storm events turbidity caused by suspended sediment transport can rise well above the criterion of 50 NTU above measurements at the upstream background station.. Peak turbidities of 600 to 1,000 NTU were observed during these events. When the background station is compared these values are well above the salmonid sight feeding criterion (Table 3), indicating the stream is water quality limited for sediment.

#### **2.3.2.9. Sediment Data**

Available sediment data for the streams and model results are summarized in the following sections.

##### **2.3.2.9.1. Riffle Armor Stability**

A quantitative index of stream bed instability is the riffle armor stability index (RASI)(Kappesser, 1993). The measurement is not of value for the Coeur d'Alene River below the reach terminating at Skeel Gulch (4018). The measurement is of value above this point and in the tributaries to the river and the lake. Unfortunately, data of this type has not been collected for any of the water quality limited segments of the sub-basin.

##### **2.3.2.9.2 Residual Pool Volume**

One consequence of stream sedimentation is a loss of pool volume through pool filling. The

amount of pool volume in streams can be estimated using residual pool volume measurements. Residual pool volume is the volume a stream pool would occupy if the stream reached a zero discharge condition. Under this condition water would not flow over stream riffles, stream runs would hold little water and the pools would make up the majority of the wetted volume of the stream. Residual pool volume is calculated using a box model from measurements of average pool depth, average pool width, pool length and average pool tailout depth. Average pool tailout depth is subtracted from average pool depth to develop the third side of the box model. Residual pool volume is normally developed for a reach of stream twenty times bank full width in length. The values are normalized on the basis of pool volume per mile of stream. Residual pool volume increases with stream width. For this reason, residual pool volume values must be stratified by stream width to assess the relative amount of pool volume. Residual pool volume data for the water quality limited segments has been stratified by bankfull stream width (Table 10). The measurement has little meaning in the Coeur d'Alene River, which as a low gradient Rosgen C channel, is a single pool below the Cataldo boat ramp. It does help gage the level of sedimentation of smaller high gradient streams, especially in the Belt terrane. Residual pool volumes are adequate in Latour and Wolf Lodge Creeks. Volumes in Marie, Lake and Fourth of July Creeks appear diminished with respect to the amount measured in the much smaller Willow Creek. The lack of pools in Cougar, Kid and Mica Creeks may be the result of assessment of low gradient reaches of these streams or that these streams are located on granitic terrane with far more sand as sediment. This assessment has not been made on all water quality limited streams of the sub-basin.

Table 10: Mean residual pool volume and stream width for the water quality limited segments of the Coeur d'Alene Lake and River Sub-basin. Streams are stratified by bankfull width.

Stream	HUC Number	Bank Full Width (ft)	Residual Pool Volume (ft <sup>3</sup> /mi)
Latour Creek	17010303 3535	24.7	34,969
Wolf Lodge Creek	17010303 3541	14.0	35,995
Marie Creek	17010303 7541	13.7	13,181
Lake Creek	17010303 3549	10.1	17,304
Fourth of July Creek	17010303 3534	10.0	18,737
North Fork Mica Creek-Mica Creek	17010303 3547	8.3	0
Cougar Creek	17010303 3545	7.8	0
Willow Creek	17010303 3531	6.9	45,678
Kid Creek	17010303 3546	6.0	0
Cedar Creek	17010303 3541	N.D.	N.D.
Fernan Creek	17010303 3543	N.D.	N.D.
Baldy Creek	17010303 7535	N.D.	N.D.
Larch Creek	17010303 7536	N.D.	N.D.
Thompson Creek	17010303 3530	N.D.	N.D.

Note: Data developed from IDEQ (Hartz, 1993)

### 2.3.2.10. Fish Population Data

Sedimentation can interfere with natural trout recruitment and cause the filling of pools. The effect may be reflected in the trout populations. Trout population density has been assessed in some tributaries of the lake and river by DEQ beneficial use reconnaissance teams. The Coeur d'Alene Tribe has developed fish population data for Lake Creek (Appendix A).

Cutthroat and brook trout are the salmonids found in these tributaries. Trout population densities (salmonid/m<sup>2</sup>/ hour effort) of the listed segments are summarized in Table 11. Reference streams, elsewhere in the Coeur d'Alene River basin, range from 0.1 - 0.3 salmonid/m<sup>2</sup>/hour effort (IDEQ, 1999). Similar population density was found for reference streams in granitic geologic settings near Priest Lake (Fitting and Dechert, 1997). It is necessary to default to these reference streams, because no appropriate references have been assessed in the sub-basin. Where data are available in the sub-basin, trout density values in most water quality limited segments are an order of magnitude lower than these reference values. The exceptions are Cedar and Cougar Creeks, which have values above the range of the reference values. Three age classes of salmonids were found only two streams; Latour and Cougar Creeks. Sculpin population density was typically found in a range of 0.1 - 0.5 fish/m<sup>2</sup>/hour effort in reference streams (IDEQ, 1999). This range or slightly higher was found in sub-basin streams where data is available, except for Mica Creek. Sculpin may not be favored by the sandy bottom of this stream, where cobble is not available for the cover these fish use. Tailed frogs were found exclusively in Cedar Creek.

Table 11: Fish population per unit stream area of the water quality limited segments of the Coeur d'Alene Lake and River Sub-basin.

Stream	HUC Number	Salmonid Density (fish/m <sup>2</sup> /hr effort)	Presence of Three Salmonid Age Classes	Sculpin Density (fish/m <sup>2</sup> /hr effort)	Presence of Sculpin and/or Tailed Frogs
Coeur d'Alene River	17010303 3529 - 4023	N.D.	N.D.	N.D.	N.D.
Latour Creek <sup>1</sup>	17010303 3535	0.0271	Yes	0.1834	No
Baldy Creek	17010303 7535	N.D.	N.D.	N.D.	N.D.
Larch Creek	17010303 7536	N.D.	N.D.	N.D.	N.D.
Fourth of July <sup>1</sup> Creek	17010303 3534	0.0529	No	0.6247	No
Willow Creek	17010303 3531	N.D.	N.D.	N.D.	N.D.
Thompson Creek	17010303 3530	N.D.	N.D.	N.D.	N.D.
Wolf Lodge Creek <sup>1</sup>	17010303 3541	0.0639	No	0.7204	No
Marie Creek	17010303 7541	N.D.	N.D.	N.D.	N.D.
Cedar Creek <sup>1</sup>	17010303 3541	0.6570	No	0.5734	Yes
Fernan Creek	17010303 3543	N.D.	N.D.	N.D.	N.D.
Cougar Creek <sup>1</sup>	17010303 3545	0.4537	Yes	0.3871	No
Kid Creek	17010303 3546	N.D.	N.D.	N.D.	N.D.
North Fork Mica <sup>1</sup> Creek-Mica Creek	17010303 3547	0.0600	No	0.0480	No
Lake Creek <sup>2</sup>	17010303 3549	0.0279	No	N.D.	N.D.

Note: 1- data from DEQ beneficial use reconnaissance program; 2 - data from Coeur d'Alene Tribe; N.D. - no data

### 2.3.2..11. Sedimentation Estimates:

#### 2.3.2.11.1. and Use Type Areas, Road Density and Impacts

Several tributaries to the lake and river are listed as water quality limited for sediment impacts. The river is affected by sediment in its upper segments above Skeel Gulch. Below Skeel Gulch, the river is gradient limited from carrying sediment particles larger than a fine grain of sand and is insulated from tributary sedimentation by its broad floodplain. As discussed earlier, sedimentation of the upper segments is the result of sediment loads primarily from the North and South Forks of the River. These impacts must be addressed in those watersheds.

Land use areas and roads information is required to model sedimentation. It was developed from

Geographical Information Systems (GIS) coverages. Existing coverages of land use and road systems developed by the Forest Service (CDASTDs) and Idaho Department of Lands were used where these were available (Wolf Lodge Creek). Where these were not available, canopy coverage was developed using USGS digital orthophoto quadrangles. Canopy coverage was ground verified by CWE crews cumulative watershed effects. Road coverage was available through the Idaho Department of Lands (IDL) from the Forest Service, timber companies and the counties. Forest fire coverage was supplied by the Forest Service (IPFIRES) All constructed GIS coverages were developed by Idaho Department of Lands personnel. Land use and roads data is presented in Table 12. After assessment of the watersheds by Idaho Department of Lands specialists, cumulative watershed effects (CWE) scores were developed. Additional sediment model assumptions and documentation are in Appendix B.

#### **2.3.2.11.2. Sediment Yield and Export Coefficients**

Sediment yields were developed separately for agricultural, forest lands and forest roads. The models used assume 100% export of the yielded sediment to the stream.

##### **2.3.2.11.2.1. Agricultural Land Sediment Yield and Export.**

Sediment yield was estimated from agricultural lands (pasture and dry agriculture) using the Revised Universal Soil Loss Equation (RUSLE) (equation 1)(Hogen, 1998).

Equation 1:  $A = (R)(K)(LS)(C)(D)$  tons per acre per year where:

- : A is the average annual soil loss from sheet and rill erosion
- : R is climate erosivity
- : K is the soil erodibility
- : LS is the slope length and steepness
- : C is the cover management and
- : D is the support practices.

RUSLE does not take into account bank erosion, gully erosion or scour. RUSLE applies to cropland, pasture, hayland or other land which has some vegetation improvement by tilling or seeding. Based on these soils characteristics of the agricultural land, the slope, sediment yield was developed for the agricultural land use of each watershed (Table 13). Sediment yield from agricultural lands was estimated by applying the sediment yield coefficients to the land area in agricultural use (Table 15).

##### **2.3.2.11.2.2. Forest Land Sediment Yield and Export**

Forest land sediment yield was based on sediment production rates used in the Forest Service WATSED Model (Patten, personal comm.). These are 25 tons per square mile per year with a range from 22-35 for the Kaniksu granitic terrane and 15 tons per square mile per year with a range from 12-17 for the Belt Supergroup terrane. The mean values were used for all conifer

Table 12: Land use of selected watersheds draining to Coeur d'Alene Lake and River.

Watershed	Wolf Lodge Creek	Cedar Creek	Cougar Creek	Kid Creek	Mica Creek	Thompson Creek	Willow Creek	Fourth of July Creek	Baldy Creek	Larch Creek	Latour Creek <sup>2</sup>
Pasture/ dry ag (ac)	946	77	869	906	422	820	453	1,548	0	0	257
Conifer forest (ac)	27,254	11,128	1,589	750	2,385	1,587	3,386	16,193	5,372	548	23,181
Unstocked forest (ac)	121	26	2,025	833	3,475	80	36	165	145	0	3,855
Highway (ac)	85	358	59	38	62	0	0	336	0	0	0
Forest Road (mi)	197.2	92.2	50.0	18.0	40.0	21.0	22.5	77.6	48.2	0.5	186.9
Forest road density (mi/mi <sup>2</sup> )	4.6	5.7	3.0	3.1	1.7	5.4	3.7	2.8	5.4	0.6	4.4
Stream crossings	58	23	66	10	47	23	16	76	12	0	65
Road Crossing Frequency <sup>3</sup>	0.5	0.2	1.6	0.8	0.9	2.2	1.5	1.2	1.1	0	0.5
Road Contributing (mi)	4.4	1.7	5.0	0.8	3.6	1.7	1.2	5.8	0.9	0	4.9
Road encroaching (mi)	8.8	6.3	1.9	0.3	1.6	1.3	0.9	0.4	0.4	0	6.4
CWE Score	18.9	18.9	15	10	17.8	17.3	24.6	20.2	13.3	13.3	13.3

Table 13: Estimated sediment yield coefficients dry agriculture, pasture and rangelands. <sup>1</sup>.

Watershed	Wolf Lodge Creek	Cedar Creek	Cougar Creek	Kidd Creek	Mica Creek	Thompson Creek	Willow Creek	Fourth of July Creek	Latour Creek
Rangeland (tons/ac/yr)	0.040	-	0.321	0.391	0.541	0.541	0.240	0.741	-
Pasture (tons/ac/yr)	0.030	0.040	0.030	0.050	0.050	-	0.040	0.030	0.020

<sup>1</sup> Pasture, and dry agriculture, sediment production and export based on the revised universal soil loss equation for lands of 0-2% slope.

Table 14: Estimated sediment yield coefficients for forest land uses on the terrane of the watersheds.

Land use type sediment export coefficient	(Kaniksu) Granitic Terrane	(Belt Supergroup) precambrian meta sediments Terrane
Conifer forest (tons/ha/yr) <sup>1</sup>	0.038	0.023
Unstocked forest (tons/ac/yr) <sup>1</sup>	0.055	0.027
Areas of double fire (tons/acre/yr)	0.017	0.004
Highway (tons/ac/yr) <sup>2</sup>	0.034	0.019

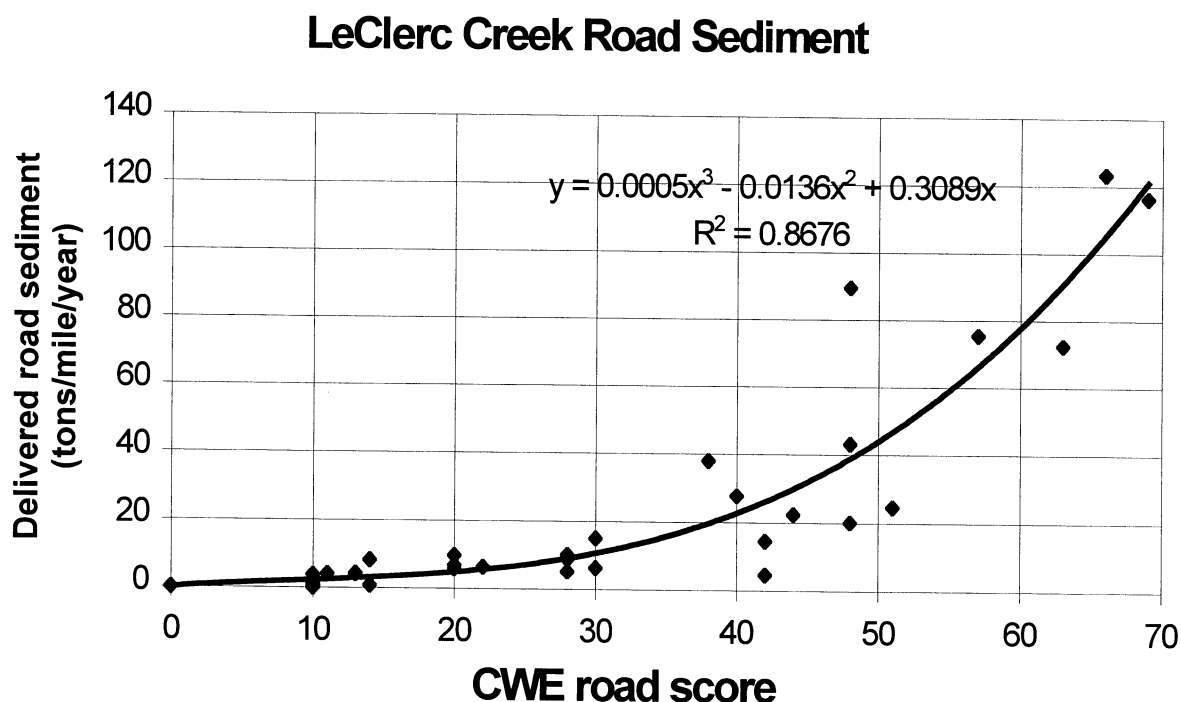
<sup>1</sup> Forest “natural” sediment production rates based on 25 tons/m<sup>2</sup>/yr (range 22-35) from Kaniksu granitics and 15 tons/m<sup>2</sup>/yr (range 12-17) for Belt Supergroup terranes. All conifer forest except unstocked acreage assumed to have median export coefficient. Unstocked forest lands(lands not meeting FPA stocking rate) assumed to have the highest export coefficient. Areas of double fires adjusted to highest coefficient.

forest, which was fully stocked. The highest values in the range were used for parcels which were not fully stocked with trees, based on the Idaho Forest Practices Act standards. The lowest value for the Belt and Kaniksu terrane were applied to highway rights of way (Table 14). Sediment yield from forest lands was estimated by applying the sediment yield coefficients to the land area in forest use (Table 15). It was assumed all yielded sediment was delivered to the stream system.

### 2.3.2.11.2.3 Forest Roads

Forest road sediment yield was estimated using a relationship between CWE score and the sediment yield per mile of road (Figure 6). The relationship was developed for roads on a Kaniksu granitic terrane in the LaClerc Creek watershed (McGreer, pers comm.). Its application

Figure 6: Sediment export of roads based on Cumulative Watershed Effects



to roads on Belt metamorphic terranes conservatively overestimates sediment yields from these systems. The watershed CWE score was used to develop a sediment load in tons per mile, which was multiplied by the estimated road mileage in the watershed yield total sediment load to streams. This road surface directly contributing was assumed to be that located 200 feet on either side of a stream crossing. (Table 12). In the case of roads, it was assumed that all sediment was delivered to the stream system. These assumptions conservatively over estimate actual delivery.

Roads deliver sediment to streams through two additional mechanisms. Road fills associated with stream crossings can fail. Based on the CWE data base, the actual fill failure and delivery was estimated. Fill failures are known to occur primarily during discharge events which reoccur every 10 - 15 years. The CWE data was divided by 10 years to estimate the watershed sedimentation from road failures in tons of sediment per year. The estimates were applicable to the specific watershed for which the CWE data were collected. The watershed wide impact was developed from road fill failure and delivery data from the road assessment scaled up by a factor reflecting the total roads in the watershed. Road fills are composed not only of fines, but course material as well. Since the road bed is most often built from the B and C horizons of the soil on hand, the percentage of fines from fill failures as compared to the course fraction (pebbles and larger). These estimates are developed from weighted averages of the major soils series of the watershed based on the STATSGO coverage of soils. Weighted averages were developed for each watershed from the weighted averages of the horizons of the major soil series in each map unit composing the watershed (Dechert, 1999)(Appendix B). These percentages are applied to the sediment yields to estimate the fines exported to the streams as compared to the pebble and larger fraction.

Many roads are sited in locations which encroach on the floodplain of the stream. This construction practice often alters the gradient of the stream. The gradient is effectively increased, because the stream length is shortened. The stream uses the resulting additional stream power to erode material and regain stream length to move towards its original steady-state gradient. The result is increased erosion and sediment export, either from the road bed or, if this is armored, from the bed and banks of the stream itself. Roads fifty feet from streams were assumed to be encroaching. The amount of erosion and subsequent sediment delivery is estimated based on the miles of encroaching stream. The bulk of the erosion is assumed to occur during the large discharge events occurring every 10 - 15 years. The materials eroded are primarily the native soils of the area with their characteristic distribution of fines and course materials. These percentages are estimated from the major soils series of the watershed. The gross deliver was divided by ten to account for the episodic nature of the mechanism's sediment delivery. Additional details on the sediment model used are available in Appendix B. The model spreadsheets for those watersheds modeled are in Appendix C.

#### **2.3.2.11.2.4. County and Private Roads**

County and private road surface erosion was modeled with the RUSLE model (Sandlund, 1999). Based on slope length, soil type and surface material, a coefficient of tons per acre per year was developed. These coefficients were applied to the area of the road 200 feet on either side of stream crossings. Since the width of county and private roads is set by ordinance, an acreage associated with this distance could be calculated.

Road fill failure and encroachment were treated as the forest roads. The CDARoads GIS coverage maps all roads; county, private and forest.

#### **2.3.2.11.2.4 Sedimentation Estimates**

Sedimentation estimates were developed by addition of the various sediment yields. The models (RUSLE, WATSED) and methods used assume complete delivery to the stream channels (Table 15).

Table 15: Estimated sediment export of watersheds listed for sediment impairment.

Watershed	Wolf Lodge Creek	Cedar Creek	Cougar Creek	Kidd Creek	Mica Creek	Thompson Creek	Willow Creek	Fourth of July Creek	Baldy Creek	Larch Creek	Latour Creek
Pasture/ dry ag (tons/yr)	28.4	2.3	78.3	88.6	130.3	24.7	18.1	46.4	0.0	0.0	5.1
Conifer forest (tons/yr)	626.9	256.0	298.5	71.7	463.9	43.0	77.9	372.4	123.6	12.6	533.2
Unstocked forest (tons/yr)	3.2	0.8	10.4	4.3	3.6	2.2	1.0	4.5	3.9	0.0	104.1
Highway (tons/yr)	1.6	6.8	2.0	1.3	2.1	0.0	0.0	6.4	0.0	0.0	0.0
Road Crossing Fine (tons/yr)	53.3	30.2	25.0	8.8	36.3	13.9	12.1	55.4	4.5	0.0	30.8
Road Fills (tons/yr)	0.1	1.4	42.7	0.0	3.3	0.0	0.0	1.3	0.0	0.0	38.7
Road Encroaching (tons/yr)	47.2	33.8	10.2	1.6	8.6	7.0	4.8	2.7	2.2	0.0	72.9
Bank Erosion (tons/yr)	33.0	-	-	-	-	-	-	-	-	-	-
Total (tons/yr)	792.7	331.3	476.1	176.3	647.8	90.8	117.9	489.1	134.2	12.6	784.8